THE UNITY OF A SCIENCE: ST. THOMAS AND THE NOMINALISTS

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IT is a commonplace to speak of science as a body or system of knowledge. Contemporary philosophers of conflicting and even contradictory persuasions are alike in using this language. That science is a body of knowledge flows as easily from the pen of a Thomist as from that of a logical positivist, however different their understanding of the words may be. There is general agreement that science is composed of many items, whether they be thought of as propositions, truths, phenomena, or simply data, and that these items are unified in a science so as to constitute a whole. So common is this notion that it has been enshrined in our dictionaries. The *Oxford Dictionary* calls science an "organized body of the knowledge that has been accumulated on a subject,"[1] and *Webster's Dictionary* gives as one meaning of science "any department of systematized knowledge."[2]

It is not difficult to trace the notion of science as a unified body of knowledge to the dawn of modern philosophy. In various guises it is found in the works of Francis Bacon, Descartes, Leibniz, Condillac, Auguste Comte, the French encyclopedists Diderot and d'Alembert, and Kant.[3] It was Kant who gave this notion its classic expression. Science, in his view, is not just any doctrine, but one that forms a system, by which he means "a totality of knowledge arranged according to principles."[4] Kant writes: "... systematic unity is what first raises ordinary knowledge to the rank of science, that is, makes a system out of a mere aggregate of knowledge."[5] Science is no mere aggregate (*coacervatio*) but an organized unity (*articulatio*). Each science is an organic

1 *The Concise Oxford Dictionary,* 3rd ed. (Oxford 1934) p. 1065.

2 *Webster's New Collegiate Dictionary* (Toronto 1961) p. 757.

3 See R. McRae, *The Problem of the Unity of the Sciences: Bacon to Kant* (Toronto 1961).

4 "Eine jede Lehre, wenn sie ein *System,* d.i. ein nach Prinzipien geordnetes Ganze der Erkenntnis, sein soll, heisst Wissenschaft..." Kant, *Metaphysische Anfangsgründe der Naturwissenschaft,* Vorrede, *Sämtliche Werke* (Leipzig 1921) IV, p. 547.

5 Kant, *Critique of Pure Reason,* trans. N. K. Smith (London 1950) A 832, B 860.

unity built around an a priori idea, that is to say one that is not derived from experience but is furnished by reason itself. In order to illustrate the organic character of the unity of a science Kant compares a science to an animal body: like a living body it is a self-sufficient whole that grows from within and not by the addition of external parts.[6]

Leibniz was just as certain as Kant that a science is a logically ordered system of truths, though he conceived its unity in a different manner. In his view, an individual science is not a self-sufficient whole with an organic unity but an arbitrary and conventional combination or synthesis of concepts. Strictly speaking, there is but one science — the logical synthesis of all truths. Leibniz granted some value to the ancient division of science into physics, ethics, and logic, but he thought that ultimately the division broke down because each of these sciences could contain the others. Physics, for example, can embrace all the truths of logic and ethics; for physics treats of beings endowed with intelligence and will, and a complete explanation of intelligence requires the whole of logic, and a full account of the will embraces the whole of ethics. Leibniz remarks that the encyclopedists have encountered this difficulty in arranging their dictionaries of science and philosophy. "It is usually found," he says, "that one and the same truth may be put in different places according to the terms it contains, and also according to the mediate terms or causes upon which it depends, and according to the inferences and results it may have."[7] In this connection he praises the nominalists, who (he writes) "believed that there were as many particular sciences as truths, which they composed after the manner of wholes, according as they arranged them."[8]

Who were these nominalists who shattered science into myriad fragments and then arranged them in arbitrary combinations? Unfortunately Leibniz does not name them; but he gives us a clue to their background, and possible identity, when, in a treatise on the contemporary nominalist Mario Nizolius, he gives a brief account of the rise of nominalism in the Middle Ages.

The nominalists, Leibniz writes, were the most profound scholastic sect and the one most in harmony with the spirit of modern philosophy. Almost all the modern reformers of philosophy, he goes on to say, are nominalists, maintaining that individuals alone are real and rejecting the reality of universals, which they consider to be simply names

6 *Ibid.* A 833, B 861. For Kant's conception of science, see R. McRae, *ibid.* pp. 123-143.

7 Leibniz, *New Essays concerning Human Understanding*, IV, xxi, 4; trans. A. G. Langley (La Salle 1949) p. 623.

8 Leibniz, *ibid.* See R. McRae, *ibid.* pp. 7-8.

(*nomina*). The sect of the nominalists is said to have begun with Roscelin, and after suffering eclipse for many years it was suddenly revived by William Ockham, a man of the highest genius and of outstanding erudition for his time. In agreement with him were Gregory of Rimini, Gabriel Biel, and the majority of the Augustinian Order. Thus it is that the early writings of Martin Luther reveal an affection for nominalism; and with the passage of time it began to influence all the monks.[9]

Thus Leibniz leads us to medieval nominalism for the origin of the notion of science as a unified body of knowledge. In this paper I should like to suggest that this notion of science indeed began with the nominalist and conceptualist theologians of the late 13th and early 14th centuries, and that its chief theoretician and popularizer was William of Ockham. I am not arguing that the medieval nominalists were Leibnizians or Kantians, but only that in the late Middle Ages there grew up a common notion of science as a collection of truths or propositions unified by principles, and that this notion was passed on by them to early modern philosophers, each of whom interpreted it in his own way. I should also like to suggest that this notion of science was conceived in opposition to St. Thomas' doctrine of science, according to which an individual science is not in essence or primarily a system or body of knowledge but a single and simple *habitus* of the intellect. The story of the development of the notion of science as a body of knowledge is another chapter in the eclipse (and sometimes misunderstanding) of Thomism during the late Middle Ages.

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St. Thomas inherited from Aristotle the notion of science as a stable disposition or *habitus* (ἕξις) of the intellect. As such it is an intellectual virtue, a perfection of the mind acquired by repeated acts enabling its possessor to demonstrate truths through their causes or principles.[10]

In this view, each of the sciences is a distinct mental facility of demonstration and insight. Ontologically, St. Thomas regards a scientific *habitus* as a simple form or quality: one *habitus* is not composed of many *habitus* (*habitus est qualitas simplex non constituta ex pluribus*

9 Leibniz, *Dissertatio de Stilo Philosophico Nizolii*, 28. *Opera Philosophica*, ed. J. E. Erdmann (Berlin 1840) pp. 68-69.

10 Aristotle, *Nicomachean Ethics*, VI, 3, 1139 b 14-35. St. Thomas, *In VI Ethicorum*, lect. 3 (Rome 1969) 47, pp. 340-341.

habitibus).[11] He grants that it involves a multiplicity, in the sense that it extends to many objects. Materially considered, its objects are many, but the scientific *habitus* regards all of them from one formal perspective (*ratio*). In other words, each science has its own formal object, whose unity gives unity to the science.[12] For instance, the unity of the science of theology is based on the unity of its formal object, which is divine revelation. The theologian considers many truths, but all insofar as they have been divinely revealed, or at least insofar as they are related to divine revelation.[13] Similarly, the science of arithmetic treats of all its objects from the formal perspective of number, and geometry considers its many objects from the formal perspective of continuous quantity. Each science has thus a formal unity owing to the formal unity of its object, and in virtue of this unity it is formally distinct from the other sciences. As the habit of an intellect, it also enjoys numerical unity: it is an individual ability or facility of insight and demonstration perfecting the individual intellect of its possessor.

St. Thomas was aware of the serious objection his opponents raised against this conception of the unity of a scientific habit. Following Aristotle, he defines science as the knowledge of conclusions: it is the mental habit that enables us to demonstrate conclusions in the light of their principles.[14] Now there are many conclusions in a whole science such as geometry or arithmetic, and we can have scientific knowledge, both actual and habitual, about any one of them independent of the others. So it would seem that a science is not one single habit but a complex of many.[15]

In replying to this difficulty St. Thomas in no way compromises the unity of a scientific habit. Suppose, he says, that we acquire the knowledge of one conclusion in a science by learning its appropriate demonstration. We then possess the habit of the science, though imperfectly. If we go on to master the knowledge of another conclusion in the science, we do not gain an additional habit; our previous habit simply becomes more perfect by extending to more demonstrations and conclusions, all of which are mutually related and ordered. So there is no need to think that a scientific habit is a complex of many partial

11 *Summa Theol.* I-II, 54, 4. On the notion of a habit as a quality disposing one to act well or badly, see *ibid.* I-II, 49, 1.

12 For the distinction of cognitive habits according to their formal objects, see *ibid.* I-II, 54, 2.

13 *Ibid.* I, 1, 3.

14 *In VI Eth.* lect. 3, p. 341, lines 101-116. See Aristotle, *Nic. Ethics* VI, 3, 1139 b 14-35; 6, 1140 b 31-33.

15 *Summa Theol.* I-II, 54, 4, obj. 3.

habits: it is a single quality or form, capable of indefinite increase in perfection by extending to a greater number of objects.[16]

It will be noticed that while St. Thomas is making his main point concerning the unity of a scientific habit, he adds another: that this habit is related to a multitude of mutually related demonstrations and conclusions. From the latter point of view a science appears as having a complex structure. "The conclusions and demonstrations of one science," he writes, "have an order, and one flows from another."[17] Adopting this perspective, a science is seen to have a systematic structure that can be studied for its own sake, for example by the logician. From this point of view St. Thomas analyzes science in his commentary on the *Posterior Analytics,* showing that a science has its own subject and principles, from which it draws its conclusions.[18] In a sense, then, a science is a systematic whole according to St. Thomas. Its demonstrations and conclusions are mutually related and form an ordered whole. But the unity of the system is based on the unity of the single mental habit which is the principle of the whole science. The habit is the principle by which (*principium quo*) the scientist demonstrates all his conclusions and establishes an order among them. Without this one *habitus* there would be no systematic unity in the activities and conclusions of the scientist.

As we shall see, many scholastics of the later Middle Ages lost sight of the unity of the mental habit that essentially constitutes a science. They describe a science simply as an orderly collection of many mental habits or concepts or propositions. In their view, the unity of a science is that of an ordered or systematic whole, and not that of a single mental habit.

Even some Thomists, in their concern to be "modern," interpreted their master in this sense. Cajetan, writing shortly after 1500, refers to certain Thomists who thought St. Thomas vacillated between the opinions that a science is one *habitus* of the intellect and that it is an orderly collection of intelligible species in the mind.[19] They believed that he inclined to the second view. They based this interpretation on statements of St. Thomas describing science as a totality and ordered

16 "Dicendum quod ille qui in aliqua scientia acquirit per demonstrationem scientiam conclusionis unius, habet quidem habitum, sed imperfecte. Cum vero acquirit per aliquam demonstrationem scientiam conclusionis alterius, non aggeneratur in eo alius habitus; sed habitus qui prius inerat fit perfectior, utpote ad plura se extendens, eo quod conclusiones et demonstrationes unius scientiae ordinatae sunt, et una derivatur ex alia." *Summa Theol.* I-II, 54, 4, ad 3.

17 *Ibid.*

18 *In I Post. Anal.* lect. 17 (Rome 1882) I, pp. 204-207; lect. 41, p. 305, n. 7.

19 Cajetan, *Comm. in Summa Theol.* I-II, 54, 4 (Rome 1891) VI, p. 345, n. 2-5.

aggregate. For example, in the *Summa contra Gentiles* he speaks of the *habitus* of knowledge in two senses: 1) as an ability (*habilitatio*) of the intellect to receive intelligible species by which it becomes actually understanding, and 2) as "the ordered aggregate of the species themselves existing in the intellect, not in complete actuality but in a way between potency and act."[20] From this and similar texts, these Thomists concluded that a scientific habit is composed of intelligible species and hence that it is an ordered whole or totality.

But as Cajetan rightly remarks, these Thomists (one of whom was Capreolus) misinterpret their master. St. Thomas' constant teaching is that a science is essentially a simple quality or *habitus* of the mind. This *habitus* is produced by repeated acts and by intelligible species, but neither the acts nor the species constitute the *habitus* itself. A text from St. Thomas' *De Veritate* clearly states the relation of intelligible species to a scientific *habitus*: "... an ordering of [intelligible] species produces a *habitus*."[21] Cajetan comments that St. Thomas does not say that the species *are* the *habitus,* but that they *produce* it. He also points out that, according to St. Thomas, we use an orderly group of intelligible species when we think scientifically by means of the *habitus*.[22]

Why, then, does St. Thomas sometimes call an ordered aggregate of intelligible species a scientific habit? The answer would seem to be that he applies the term *habitus* to these species because of their special relation to it. They are the habit in the sense that the habit derives from them and in turn uses them; but properly speaking they do not constitute it. Hence, only in a derived and secondary sense can they be called the habit.

St. Thomas often uses terms in primary and secondary senses in order

20 "Omnis autem intellectus in habitu per aliquas species intelligit: nam habitus vel est habilitatio quaedam intellectus ad recipiendum species intelligibiles quibus actu fiat intelligens; vel est ordinata aggregatio ipsarum specierum existentium in intellectu non secundum completum actum, sed medio modo inter potentiam et actum." *Summa contra Gentiles* I, 56, § 6.

St. Thomas holds, contrary to Avicenna, that intelligible species remain in the intellect in a state of incomplete actuality even when they are not actually being employed by the intellect. *Ibid.* II, 74. Hence their orderly arrangement in the intellect constitutes a kind of habitual body of knowledge.

21 *De Veritate* 24, 4, ad 9.

22 Cajetan, *ibid.* p. 347, n. 12. According to Cajetan, the species are the beginnings of the habit and its potential parts. *Ibid.* Likely he has Capreolus in mind as one of the Thomists who misinterpreted St. Thomas on this point. See Capreolus, *Defensiones Theologiae Divi Thomae Aquinatis,* Prol. q. 3, a. 1, concl. 1 (Turin 1900) I, p. 34. Soncinas (d. 1494) also held that a science is not a simple quality but a related grouping of intelligible species: "... tamen magis videtur quod scientia sit aggregatio specierum, vel ut melius dicam quod sit ipsae species aggregatae; et consequenter quod una totalis scientia sit constituta ex multis notitiis partialibus, ita quod per quamlibet demonstrationem acquiratur nova notitia." Soncinas, *Quaestiones Metaphysicales* VI, q. 9 (Venice 1505) fol. 59v.

to express the nuances of his thought. He does not always speak *formalissime*. His use of the term *habitus* seems to be a case in point. Another instance is his extension of the term to the propositions that are held to be true by means of the habit. In his *Summa Theologiae* he distinguishes between two meanings of the term *habitus*.[23] Essentially and properly it means the habitual inclination or disposition to act in a certain way; but in a secondary and derived sense it means that which is produced or held by the habit. In this latter sense the term can be extended to mean the propositions held to be true by means of the habit. St. Thomas illustrates this distinction by the habit of faith. In the proper sense, faith is the habit by which we believe certain truths; in a derived sense, however, we can speak of "the faith" as that which we hold on faith. In this extended and analogous use of the term it is legitimate to speak of science objectively as a synthesis or system of truths or propositions; but for St. Thomas this is not the primary or proper meaning of the term. Properly, a science is a habit of the intellect, and this habit is radically one and simple.

In later scholasticism the secondary and extended senses of the term "science" gradually came to the fore, supplanting its primary and essential meaning. A science was then conceived as an orderly arrangement of many partial habits of the intellect, or of terms and propositions.

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This shift in the meaning of a science was not long in coming. Shortly after the death of St. Thomas a lively debate began whether a science is properly speaking a simple habit of the mind or a synthesis of many habits or acts or propositions. Henry of Ghent was no Thomist, but on this question he held firmly to the Thomistic view of the unity of a scientific habit. In the proper sense, he says, *scientia* has three meanings: 1) the intellectual habit hidden in the intellectual memory, 2) the concept elicited from this habit, 3) the act of understanding by which the concept is conceived.[24] The scientific habit contains within its

23 "Dicendum quod aliquid potest dici esse habitus dupliciter. Uno modo, proprie et essentialiter; et sic lex naturalis non est habitus. Dictum est enim supra quod lex naturalis est aliquid per rationem constitutum, sicut etiam propositio est quoddam opus rationis. Non est autem idem quod quis agit, et quo quis agit; aliquis enim per habitum grammaticae agit orationem congruam. Cum igitur habitus sit quo quis agit, non potest esse quod lex aliqua sit habitus proprie et essentialiter. Alio modo potest dici habitus id quod habitu tenetur, sicut dicitur fides id quod fide tenetur." *Summa Theol.* I-II, 94, 1.

24 "... sunt alii tres modi notitiae quae proprie dicenda est scientia. Unus enim modus notitiae quae est scientia, est habitus intellectualis latens in memoria intellectuali. Alio modo verbum con-

power (*virtualiter*) the whole science, with all its concepts, principles, and conclusions; and it is not really composed of parts, but is a simple form or quality acquired by repeated acts, like the moral virtue of temperance. The habit is not a synthesis (*collatio*) of many propositions — principles and conclusions — but the intellectual facility inclining one to elicit all the acts proper to the science.[25]

For Henry of Ghent, if the word "science" is taken not in a generic but a most specific sense (for example, if it means a specific science like metaphysics), it is not really composed of many items, but it is as simple and incomplex as a moral virtue or the quality of whiteness. Like them, it is a form, simple in itself, but capable of greater or less perfection. The whole reality of the habit is present through the first act that generates it, as the whole reality of whiteness exists as a result of the first act that produces it. At first it exists most imperfectly, but it can increase later to its perfect degree.[26]

A Dominican by the name of Bernard of Auvergne (also called Bernard of Gannat from his birthplace), who lectured at Paris between 1294 and 1297, wrote a long defense of St. Thomas against Henry of Ghent, but ironically he adopted a stand on the unity of a science opposed to his master. On this point Henry was closer to St. Thomas than Bernard. Bernard was not at all pleased with Henry of Ghent's likening the simplicity of a scientific habit to that of a moral virtue. To Henry's conclusion that "science is not a composite," he retorted that if we speak of science as an intellectual habit it is indeed something composite, for it is a suitable arrangement of intelligible species in the intellect (*debita ordinatio specierum intelligibilium*). The habit of science, which enables us to understand promptly and at will, is comprised of many such species, and hence it is really composed of parts.[27] Bernard

ceptum ex illo in intelligentia. Et tertio modo ipse actus intelligendi quo concipitur, qui non potest dici verbum nisi ea ratione qua verbo conceptus informatur, ut iam amplius dicetur." Henry of Ghent, *Quodlibet* IV, q. 8 (Paris 1518) fol. 98r.

25 *Ibid.*

26 "Et est dicendum quod quaelibet scientia quae est habitus in specialissimo scientiae consistens, unicus est et simplex in re, carens omni compositione reali ex diversis secundum rem ut partibus existentibus et manentibus in ipso, et hoc aequali simplicitate illi quam habet quilibet habitus affectivus, et universaliter quaelibet forma una recipiens intensionem et remissionem, et hoc secundum modum iam supra tactum. Unde non est minor simplicitas in habitu scientiae Metaphysicae in quocumque gradu habeat eam aliquis quam in habitu temperantiae et quam in albedine. Ita quod per primum actum generativum habitus habetur tota realitas habitus, quemadmodum ex primo actu generativo albedinis habetur tota realitas albedinis, licet in gradu imperfectissimo, a quo habet procedere per intensionis motum ad gradum perfectum." Henry of Ghent, *Quodlibet* IX, q. 4, fol. 355rv.

27 "Ergo habitus scientiae non est habilitas intellectus ad intelligendum sicut sunt habitus qui sunt in viribus appetitivis, sed est ordinatio specierum secundum quam intellectus prompte intelligit cum voluit. Ergo cum ad habitum scientiae requirantur species multae, ex quibus iste

was clearly relying on St. Thomas' statements about science and intelligible species which were quoted above; but, as Cajetan has pointed out, these statements cannot be used to deny the simplicity of a scientific habit. On this question, Bernard, whom B. Hauréau called "one of the most intelligent students of St. Thomas and one of the most zealous defenders of his master,"[28] proves to be less Thomistic than Henry of Ghent.

Few scholastics in the years that followed failed to take up the problem of the unity of a science, generally (because they were theologians) in connection with the science of theology. It would be impossible here to do justice to this debate, which is of considerable importance for the development of the notion of science as a body of knowledge. All that can be done is to touch upon some of its most salient moments.

The Franciscan Peter Auriol, commenting on the *Sentences* between 1316 and 1318, devoted considerable attention to the present problem. He dismisses the opinion of Bernard of Auvergne, that a scientific habit is an orderly collection of intelligible species, and also that of St. Thomas and Henry of Ghent, that a science is a simple and indivisible form or quality of the intellect.[29] After a lengthy discussion of the subject, in which he weighs the opinions of many of his predecessors and contemporaries, he concludes that a science is not one simple individual habit of the mind but a composite of many incomplete and imperfect habits, united to form one whole. What decides the issue for him is the fact that we can acquire the mental facility of demonstrating one conclusion in a science without the facilities of demonstrating others. To him, this proves conclusively that these facilities or habits are really distinct, and that many of them go to make up a total science.[30]

As for the kind of unity these habits have within a science, Auriol denies that they are a mere aggregate (*acervus*), like many stones in a

habitus integratur, videtur quod scientia habet talem materiam ex qua fit et per consequens quod sit composita. Bernard of Auvergne, *Contra Dicta Henrici de Gandava quibus Impugnat Thomam, Quodlibet* IX, q. 4, Ms Troyes 662, fol. 123rab. "Praeterea, scientia ut est habitus non est nisi debita ordinatio specierum intelligibilium." *Ibid.* fol. 123ra. On Bernard of Auvergne, see F. J. Roensch, *Early Thomistic School* (Dubuque Iowa, 1964) pp. 104-106.

28 B. Hauréau, *Histoire de la philosophie scolastique* (Paris 1872-1880) II, p. 206.

29 For Auriol's criticism of Bernard of Auvergne, see his *Scriptum super primum Sententiarum*, prooemium, sect. 4, n. 34-39 (St. Bonaventure, New York 1952) I, pp. 260-261. For his criticism of Henry of Ghent, see *ibid.* n. 25-28, pp. 256-258; for his criticism of St. Thomas, see *ibid.* n. 58-62, pp. 270-271. For a more complete account of Auriol's doctrine of the unity of a science, see P. Spade, "The Unity of a Science according to Peter Auriol," *Franciscan Studies* 32 (1972) 203-217.

30 See *ibid.* n. 26-28, pp. 257-258. For Auriol's notion of a scientific habit, see *ibid.* pp. 262-267.

heap. Neither are they linked together like potential parts of a continuous whole, as one whiteness has potentially many parts. Rather, they are parts of one totality, having an inner structure or form. A science has the same kind of unity as a house, which is one because of the unity of its form, or as a geometrical figure, which is one because of the total form resulting from its lines.[31]

Auriol contends that a formal unity of this sort suffices for a scientific habit and is consistent with the way we ordinarily talk about a science. We say that one acquires a science little by little; that one is in error regarding the twentieth conclusion of a science while knowing the first; that there are not as many natural sciences as there are conclusions in the science, and so on. Clearly there is formal unity in a specific science along with a multiplicity of acts and mental habits disposing towards them.[32] As for the ground of this formal unity, Auriol refuses to place it in the formal object of the science. If a science were one because it had one formal object, he contends, this formal object would have the unity of an *infima species*, a subalternate genus, or a most general genus. In the first case, there would be as many sciences as there are *infimae species*; in the second, sciences would be multiplied according to subalternate genera; in the third, there would be only ten sciences corresponding to the ten categories. If being were the formal object of science, there would be only one science, especially if there were only one concept of being. Consequently, the formal unity of a science cannot be based on the unity of its formal object. The unity of a science comes from its unique mode of knowing, of understanding its premises and deducing its conclusions, of abstracting its objects and relating them to the senses, imagination, and the external world. In short, each science has its own logic which distinguishes it from every other science and confers on it its formal unity.[33]

31 *Ibid.* n. 54, p. 267. "Haec autem scientia unitatem habet, non simplicitatis et indivisibilitatis omnimodae, sed cuiusdam totalitatis et unius formae. Est autem illa forma connexio omnium partialium habituum, vel secundum longum, vel secundum [latum]; sicut enim dicit Philosophus I Posteriorum, demonstrationes densantur dupliciter, uno modo in post assumendo, ut cum ex una conclusione infertur alia demonstrative; et istarum conclusionum connexio est secundum longum; quae quidem connexio locum habet in passionibus ordinatis, secundum mediationem et immediationem ad primum subiectum. Alio modo densatur secundum latum, ut cum ex eodem medio plures passiones concluduntur de subiecto non ad invicem ordinatae." *Ibid.* n. 56, p. 268.

32 "Quod autem haec unitas sufficiat pro habitu scientiali, patet ex duobus. Primo quidem quia est unitas formalis; sicut enim ratione unionis maioris extremitatis et minoris in medio, syllogismus est unus unitate formali, sic, ratione istius ordinis perfectivi et unionis cognoscitivae, scientia una erit unitate formali. Secundo vero, quia tali posita unitate, salvantur omnia quae de scientia dicuntur..." *Ibid.* n. 57, p. 269.

33 "... unaquaeque scientia habet propriam logicam et proprium modum sciendi... Ex quibus colligitur evidenter quod scientiae habent unitatem specificam ex modo sciendi eiusdem rationis; qui quidem consistit in uniformi acceptione principiorum, et uniformi modo demonstrandi, et

Auriol's commentary on the *Sentences* had been published only a few years when Ockham made his own commentary on Peter Lombard. Ockham acknowledges reading Auriol's work, but for no longer than twenty-four hours.[34] Certainly some of this time was spent on Auriol's Prologue, which contains his lengthy treatment of the unity of a science.

Like Auriol, Ockham refuses all attempts to place the unity of a whole science, such as physics or metaphysics, in one simple habit of the intellect. Each of these sciences, he maintains, is made up of many intellectual habits or propositions arranged in a definite order. If one wishes, he can call a science a single habit or quality, but then he is talking about the facility of demonstrating only one conclusion in a whole science. As the term is generally used, it denotes

> a collection of many items belonging to the knowledge of one or many objects having a definite order. In this sense, science contains both the incomplex knowledge of terms and the knowledge of propositions, both principles and conclusions. It also comprises the refutations of errors and the solutions of sophisms. It also frequently contains necessary divisions and definitions... Science in this meaning of the term is taken as the compilations and treatises of authors and philosophers... This is the meaning of science when the book of [Aristotle's] *Metaphysics* or *Physics* is said to be one science. Science in this sense is not one in number but contains many habits distinct not only in species but frequently also in genus. But they are mutually ordered, and owing to this special order, which other objects of science or knowledge do not have, they can be called, and are called, in common usage, one science.[35]

Ockham appeals to experience to show that science is a stable disposition or habit of the mind. We are aware, he says, that as a result

deducendi conclusiones ex ipsis, et uniformem modum se habendi intellectus penes abstractionem et extensionem ad extra; et quod omnis res, quae exigit ista propria et distincta, habet propriam scientiam." *Ibid.* n. 87, p. 279. See n. 101, p. 282.

34 "... quia tamen pauca vidi de dictis illius doctoris, si enim omnes vices quibus respexi dicta sua simul congregarentur, non complerent spatium unius diei naturalis." Ockham, *In I Sent.* d. 27, q. 3, H (Lyons 1495). See P. Vignaux, "Occam," *Dictionnaire de théologie catholique* XI, 886.

35 "Ad primum istorum dico quod scientia, ad praesens, dupliciter accipitur. Uno modo pro collectione multorum pertinentium ad notitiam unius vel multorum determinatum ordinem habentium. Et scientia isto modo dicta continet tam notitiam incomplexam terminorum quam notitiam complexorum, et hoc principiorum et conclusionum; continet etiam reprobationes errorum et solutiones falsorum argumentorum; continet etiam divisiones necessarias et definitiones, ut frequenter... Et isto modo accipitur scientia pro compilationibus et tractatibus auctorum et philosophorum... Sic etiam accipitur scientia quando dicitur liber *Metaphysicae* vel liber *Physicorum* esse una scientia. Et scientia ista non est una numero, sed continet multos habitus non tantum specie sed etiam frequenter genere distinctos, ordinem tamen aliquem inter se habentes, propter quem ordinem specialem, qualem non habent aliqua alia scibilia vel cognoscibilia, possunt dici et dicuntur, secundum usum loquentium, una scientia." Ockham, *In I Sent.* Prol. q. 1 (St. Bonaventure, New York 1967) I, pp. 8-9. For Ockham's doctrine of the unity of a science, see A. Maurer, "Ockham's Conception of the Unity of Science," *Mediaeval Studies* 20 (1958) 98-112.

of repeatedly knowing some object we are more ready and able to know it than before. Repeated acts of knowing produce in us a new promptness or facility of knowing called *scientia*. The habit may be simply one of apprehending a certain term or proposition; or it may be one of demonstrating a conclusion from principles. In the latter case it is science in the strict sense. It is also a matter of experience that distinct acts of demonstrating conclusions engender in us distinct habits of knowing, or sciences. There are, in other words, as many scientific habits in us as there are distinct acts of demonstrating conclusions.[36]

Both St. Thomas and Henry of Ghent come under Ockham's criticism for making a whole science consist of one indivisible intellectual habit. Their position rests on the presupposition that every scientific habit has one formal object (as St. Thomas claims) or one formal mode of knowing (as Henry of Ghent says).[37] Just as a power of the soul has one formal object (as color, for example, is the formal object of sight), which gives unity to the power and distinguishes it from every other power, so a science has a formal object which gives unity to the science and differentiates it from all others. But Ockham contends that the unity of neither a power nor a habit can be established on the basis of the unity of its formal object; nor can the distinction of powers or habits be based on the distinction of their formal objects. He strikes at the foundation of St. Thomas' doctrine of the unity and distinction of habits and powers by denying the distinction between a material and formal object, for reasons that take us to the heart of his nominalism.

If St. Thomas is correct, Ockham argues, many materially different items share in a common nature (*ratio*). For example, a man and a stone would have in common the nature of being colored. Accordingly, they would fall under the sense of sight, whose formal object is color. Similarly, the objects studied in theology, according to St. Thomas, share in the common *ratio* of being revealed, and so they can be considered by the one science of theology, whose formal object is "the divinely revealable." But in the perspective of Ockham's nominalism, no two items have anything in common. In his view, it is absurd to speak of a number of things presenting to the mind a common intelligible or formal object. Every reality or thing is individual and one in number and it shares nothing in common with anything else. Only terms or concepts are common or universal, in the sense that they are predicable of many things. But *things* themselves are not common or

36 Ockham, *Expositio super libros Physicorum*, Prol.; ed. P. Boehner, *Ockham: Philosophical Writings* (Edinburgh, London 1957) 4-7. (Henceforth referred to as *Physics*).

37 Ockham, *In I Sent.* Prol. q. 8, pp. 208-217.

universal. St. Thomas' doctrine of the unity and distinction of sciences based on their formal objects contradicts this basic tenet of Ockham's nominalism. It also compromises the unity of an individual thing as conceived by Ockham. St. Thomas imagines that within one reality there are many distinct *rationes*, which can be the formal objects of distinct powers and habits. But if this were so, Ockham argues, these *rationes* would be distinct realities, and the unity of the original reality would be destroyed. Thus, in Ockham's view the Thomistic distinction between the material and formal objects of sciences breaks down, and along with it the notion that faculties and sciences are distinguished by formal objects.[38]

Ockham's conception of reality as radically individual led to a new interpretation of the object of science. With Aristotle he held that science concerns universals and not individuals as such.[39] But where is the universal to be found? It was generally agreed by his scholastic predecessors that individuals in some way contain natures or essences which are the foundations of our universal concepts and which serve as the objects of science. Ockham was uncompromisingly opposed to this view. It was axiomatic for him that reality is individual and in no way common or universal. He was aware that he was going further than any of his predecessors in adopting an absolute position on this point. He writes:

> All those whom I have seen agree that there is really in the individual a nature that is in some way universal, at least potentially and incompletely; though some say that [this nature] is really distinct [from the individual], some that it is only formally distinct, some that the distinction is in no sense real but only conceptual and a result of the consideration of the intellect.[40]

Having proved to his own satisfaction that universality is a property of terms (whether spoken, written or mental), which are found in propositions, he drew the inevitable conclusion: Propositions alone are the objects of science. "Every science," he writes, "whether real or rational, is concerned only with propositions as with objects known, for only propositions are known."[41] In saying this he does not mean that

38 *Ibid.* pp. 208-211. For Ockham's doctrine of universals, see *In I Sent.* d. 2, q. 8 (St. Bonaventure, New York 1970) II, pp. 266-292.

39 Ockham, *Physics*, Prol. p. 11. See Aristotle, *Metaph.* XI, 1, 1059 b 26.

40 "In conclusione istius quaestionis omnes quos vidi concordant, dicentes quod natura, quae est aliquo modo universalis, saltem in potentia et incomplete, est realiter in individuo, quamvis aliqui dicant quod distinguitur realiter, aliqui quod tantum formaliter, aliqui quod nullo modo ex natura rei sed secundum rationem tantum vel per considerationem intellectus." Ockham, *In I Sent.* d. 2, q. 7; II, pp. 225-226.

41 "... est sciendum quod scientia quaelibet sive sit realis sive rationalis est tantum de

science in no way concerns reality. The terms of the propositions in some sciences stand for real things; for example those of natural science and metaphysics. Ockham calls these "real sciences" or sciences of reality. The terms of the propositions of logic, on the contrary, stand for concepts in the mind; so logic is called "rational science." The terms of the propositions of grammar stand for written or spoken words. Thus science does treat of individuals, but only in an improper sense, inasmuch as the terms of its propositions stand for them. Properly speaking, science deals with universals, which are terms of propositions.[42]

As for the subject of a science, it is simply the subject term in the proposition which is the object of the science. For example, when we know that every man is capable of learning, the object of this knowledge is the whole proposition: "Every man is capable of learning"; the subject is the term "man."[43]

In a total science whose unity is that of a collection or group there need not be one object or subject. The science derives its unity from the arrangement of its parts and not from the unity of its object or subject. Ockham criticizes Duns Scotus for failing to see this point. According to Scotus, a science has a primary subject which gives unity to the science because it virtually contains all the truths belonging to the science. For example, theology is one science because its primary subject is God, who virtually contains all theological truths.[44]

Ockham opposes the Scotistic explanation of the unity of a science for several reasons. To begin with, he does not think it true that a science has only one subject. He insists that a science has different parts, each of which, being a proposition, has its own subject. So it is meaningless to ask what is the subject of logic, physics, metaphysics, or mathematics. There is no one subject of the entire science; its different parts have different subjects. To ask what is the subject of these sciences is like asking who is the king of the world. There is no one man who is king of the world; one person is king of one part and another of another part. It is the same with the subjects of the various parts of a science. Each part has its own subject.[45] Ockham's comparison of a science to

propositionibus tamquam de illis quae sciuntur, quia solae propositiones sciuntur." Ockham, *In I Sent.* d. 2, q. 4; II, p. 134. See *Physics,* Prol. p. 11.

42 Ockham, *In I Sent. ibid.* pp. 134-138; *Physics,* p. 12.

43 Ockham, *Physics,* p. 9.

44 Duns Scotus, *Ordinatio,* Prol. 3, q. 1-3 (Vatican 1950) I, p. 102, n. 151; *Reportata Paris.,* Prol. 3, q. 2, n. 12 (Paris 1894) 22, p. 51.

45 Ockham, *Physics,* pp. 9-10.

the world is an accurate analogy for both have a unity of order. He writes:

> Hence we have to say that metaphysics is not a piece of knowledge that is numerically one. The same is true of the philosophy of nature, which is a collection of many habits... It is one in the same sense that a city or a nation, or an army, which includes men and horses and other necessary things, or a kingdom, or a university, or the world, is said to be one.[46]

Secondly, Ockham denies — again in opposition to Scotus — that a science has one primary subject. He insists that absolutely speaking there is no primary subject of a whole science. From one point of view one subject may be primary and from another point of view another may be primary. Thus, being is the primary subject of metaphysics in the order of predication, for the metaphysician primarily draws conclusions about being. But in the order of perfection God is the primary subject of metaphysics, for he is the most perfect being known in it. Natural substance is the primary subject of the philosophy of nature as regards priority of predication; but as regards priority of perfection its first subject is man or the heavenly bodies.[47]

Thus the attempt to establish the unity of a science on the unity of a formal object or primary subject fails. Ockham's problem is to find a principle of unity for science, conceived not as a single habit of the mind but as a collection of many items of knowledge: habits of the mind primarily, but secondarily propositions (mental, spoken, and written) which are the objects of these habits. These "partial sciences" do not by their nature belong to the whole science. An item of knowledge may be integrated into a total science, but it does not by nature belong to that science to the exclusion of another science. For example, Ockham says that the truth that God is one, or the habit of demonstrating it, is neither theological nor metaphysical in itself. It does not in itself belong to theology or metaphysics, any more than a man by himself is part of a nation or an army. Just as he can be included in either or both, so a truth can be integrated into one science or many.[48]

46 "Ideo dicendum est, quod *metaphysica non est una scientia numero, nec similiter* philosophia naturalis. Sed philosophia naturalis est collectio multorum habituum, sicut dictum est. Nec est aliter una nisi sicut civitas dicitur una vel populus dicitur unus vel exercitus comprehendens homines et equos et caetera necessaria dicitur unus, vel sicut regnum dicitur unum, vel sicut universitas dicitur una, vel sicut mundus dicitur unus." Ockham, *Physics*, p. 7.

47 *Ibid.* pp. 9-10. See Scotus, *Ordinatio*, Prol. 3, q. 3; pp. 94ff.

48 "Si dicatur quod tunc idem habitus numero esset metaphysicus et theologicus, dico, secundum praedicta, quod accipiendo habitum metaphysicum et theologicum sicut communiter accipitur et quomodo loquimur modo, neuter est unus numero sed continet multos, numero, specie et genere distinctos. Et ideo habitus ille quo cognoscitur ista veritas 'Deus est unus', qui pertinet ad metaphysicam et ad theologiam, nec est habitus metaphysicus nec theologicus, sicut nec est

Ockham is not saying that every truth will fit into every science. He points out that theology considers many subjects and attributes of subjects that are not the concern of metaphysics or any other natural science. Sciences are distinguished by both their subjects and the attributes demonstrated of them. But what determines the exact range of subjects to be treated by any one science? What marks off one body of knowledge from another as a distinct science? What is the "special relation" between the parts of a science that unifies it and makes it one science?

We have seen Peter Auriol place the unity of a science in the form of the science. He conceives a science on the analogy of a house or geometrical figure, whose parts are unified by their supervening form. But this solution of the problem is not acceptable to Ockham, for he does not think the notions of matter and form apply in this case. A science, he says, has no formal cause but only efficient and final causes.[49] Since he believes that theology is a practical science, leading to eternal beatitude, he can appeal to its end as the source of its unity: all truths necessary for salvation are theological and can be integrated into the science of theology.[50] But what is the source of unity of a speculative science like metaphysics? This science, he maintains, has only the unity of an aggregate.[51] At best it has the unity of order, like an army or city. It is made up of many partial sciences (*scientiae partiales*), some of which are still to be discovered. What gives the science its unifying order which distinguishes it from, say, mathematics?

Ockham suggests three possibilities: the order may be found in the predicates of the science, or in its subjects, or in both. In the first case, the science may demonstrate of the same subject many attributes which are logically related as superior and inferior (that is, of greater and less extension). Ockham's example is taken from geometry. This science demonstrates of the subject "figure" the attributes of magnitude, and also its own proper attributes and those of its logical inferiors (for in-

metaphysica nec theologia. Unde sicut non est concedendum quod homo est populus vel exercitus, nec domus est civitas vel villa, ita habitus ille nec est metaphysica nec theologia. Si tamen per habitum esse metaphysicum vel theologicum intelligatur istum habitum pertinere ad metaphysicam vel theologiam, sic potest concedi quod idem habitus est metaphysicus et theologicus. Concedo tamen quod idem habitus numero est pars habitus metaphysici et etiam theologici, sicut idem homo est pars populi vel exercitus." Ockham, *In I Sent.* Prol. q. 1, pp. 13-14.

49 "Ideo dicendum est quod, loquendo de virtute sermonis, nulla scientia habet nisi tantum duas causas essentiales, scilicet efficientem et finalem." Ockham, *Physics,* p. 7.

50 Ockham, *In I Sent.* Prol. q. 1; I, p. 7. For the practical nature of theology, see *ibid.* q. 12, pp. 324-370.

51 "Et ita accipiendo unitatem aggregationis pro omni unitate quae non est alicuius unius numero, concedo quod talis scientia (scil. metaphysica) est una unitate aggregationis." Ockham, *ibid.* p. 224.

stance, circle and triangle). Secondly, the order that unifies a science may be found in the subjects of the science, as when general attributes are demonstrated of their primary subjects and also of their logical inferiors. Thus in the science of animals the attributes of animal in general are demonstrated not only of animal but also of the various genera and species of animals. Thirdly, the unifying order of a science may reside in both its subjects and predicates, as, for example, the attributes of animal are predicated of animal, and the attributes of the various species of animal contained under the genus are predicated of these species. Because the terms of a science have a logical relation of this sort, or some similar logical order, it is called one science. Ockham assures us that this is the sense in which Aristotle and the other philosophers and masters understand the unity of a science.[52]

Ockham knew well enough that Aristotle locates the unity of a science in the unity of its generic subject. "A single science is one whose domain is a single genus," writes the Philosopher in his *Posterior Analytics*.[53] This Aristotelian dictum is quoted in one of the objections to Ockham's position. In reply, he does not deny it, but qualifies it in such a way that it no longer applies to a whole science. One science, he says, has one generic subject, but only if the attribute predicated of it is one; otherwise the science will have a unity of order.[54] But Ockham has already said that in a total science, like metaphysics, many attributes are predicated of many subjects. Hence, a whole science can only have a unity of order.[55] Ockham's nominalism prevents him from accepting in its full meaning the Aristotelian doctrine of the unity of a science based on the unity of its generic subject.

Closer to Aristotle in this respect was Gregory of Rimini, a master of theology at Paris and General of the Augustinian Order, who died shortly after Ockham in 1358. We have seen Leibniz list him among the leading nominalists; and indeed according to a tradition going back to about 1500 he was the standard bearer of the nominalists (*Antesignanus nominalistarum*).[56] This does not mean that he was always in agreement

52 Ockham, *ibid.* pp. 219-220. See *ibid.* q. 1, p. 14. Natural philosophy is distinguished from the other sciences either by its subjects or predicates; but this does not prevent one and the same truth from belonging to it and to other sciences. Ockham says that he intends to explain how sciences are distinguished by their subjects and predicates in his commentary on the *Metaphysics*, which he does not seem to have written. See *Physics*, p. 15.

53 Aristotle, *Post. Anal.* I, 28, 87 a 38-39.

54 "Ad secundum patet, quod unius generis subiecti est una scientia si passio sit una, vel erit una unitate ordinis." Ockham, *In I Sent.* Prol. q. 8, p. 225.

55 "Ad tertium etiam patet, quod metaphysica, prout dicit totum librum *Metaphysicae*, non est una nisi tali unitate ordinis." Ockham, *ibid.*

56 This title was given to him by Aventinus (1477-1517), according to D. Trapp. See G. Leff, *Gregory of Rimini: Tradition and Innovation in Fourteenth Century Thought* (Manchester 1961) p. 1.

with Ockham, as is clear from his notion of the unity of a science. Like Auriol and Ockham, he denies that its unity consists of a single intellectual habit. If such were the case, he argues, we would know all the principles and conclusions of a science through the one habit. Knowing one conclusion of geometry, we would know all the conclusions of the science, which is contrary to experience.[57]

For this and other reasons Gregory rejects the view that there is one all-embracing habit for one science. What, then, is the source of its identity? Gregory concludes with Aristotle that a science like geometry or medicine has its own generic subject and premises which give unity to the whole science. For example, the subject of geometry is magnitude. Because all the conclusions of the science concern this subject, they form a unity. The conclusions belong to the same science, as do the habits by which they are demonstrated. Gregory specifies that the common genus constituting the subject of a science cannot be one of the widest genera, like "quality" (that is, it is not one of Aristotle's ten categories). Gregory considers this far too universal to unify a science. Neither is the subject of a science a particular species like "man"; this would be too restrictive a subject for one science. At best this could only be the subject of a "partial" or "special" science included within a total science. The subject of a whole science has the unity of a subalternate genus; that is to say, a genus subalternated to one of the widest genera. The example Gregory gives is "magnitude," which is a genus subalternated to the more general genus "quantity." Magnitude is the generic subject of geometry, giving unity to that science. Gregory adds — again following Aristotle — that a science is said to have one subject genus not only if the items known in it are conceived univocally with one common *ratio* or notion, but also if they are conceived analogically, or having a common focus of reference. Gregory makes this qualification in order to include metaphysics among the sciences, for its subject "being" is not a genus.

More is required to unify a science than a common subject according to Gregory of Rimini. If this were sufficient, how would geometry differ from physics, since both concern magnitude? Besides a subject, a science has common premises or principles, and it regards its objects from a formal point of view different from that of the other sciences. For example, both physics and mathematics draw conclusions regarding magnitude, but mathematics has to do with magnitude as such, while

57 "Prima [conclusio] est quod non omnium conclusionum talium est habitus unus numero. Secunda est nec unius conclusionis et suorum principiorum est habitus unus numero. Tertia est nec ipsorum principiorum est habitus unus numero." Gregory of Rimini, *Sent.* Prol. q. 3, a. 1 (Venice 1522) fol. 11Q-12A.

physics regards magnitude in the external world. Each of these sciences, accordingly, has not only its generic subject but also its own principles and formal perspective, all of which give the science its identity and distinguish it from the other sciences.[58]

Gregory of Rimini's doctrine of science deserves more detailed attention than can be given here. What has been said makes it clear that his conception of the unity of a science, while in some respects similar to Ockham's, differs significantly from his. In appealing to a common generic subject and a unique formal perspective for each science as the ground of its unity, Gregory parts company with his nominalist contemporary. This is but one indication that what goes by the name of fourteenth century nominalism was really a complex of many doctrines which, though they have common features, were really quite different.

Ockham's theology and philosophy were widely disseminated in the universities of the later Middle Ages, especially through the works of his commentator Gabriel Biel, who died in 1495. Among the many Ockhamist doctrines taught by Biel was that a science is not a single habit of the intellect but a unified collection of habits. The word "science," he says, is as it were a collective name: *quasi nomen collectivum*.[59]

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If one wishes to appreciate how widely the unity of a science was discussed by the late scholastics and how diverse their views on this subject were, he has only to read Suarez' popular *Disputationes Metaphysicae,* published in 1597. In his usual thorough manner, Suarez recounts the views of many of his predecessors and contemporaries before giving his own. He cannot agree that a science is a simple and indivisible quality of the mind, as Henry of Ghent, St. Thomas, and many Thomists hold. Neither is it an ordered collection of intelligible species, as Soncinas thought. Suarez is also opposed to the nominalist view that a science is not a habit with an essential unity, but only a collection or coordination of many qualities: the opinion, he says, held by Auriol, Scotus, Gregory of Rimini, Ockham, and Biel. He opts for what he calls a "middle way" between the Thomistic and nominalist opinions, maintaining that a science is a collection or coordination of many qualities, but that these qualities comprise one scientific habit

58 *Ibid.* a. 2, fol. 14L-O.
59 G. Biel, *In I Sent.* Prol. q. 1, E (Tübingen 1501).

with an essential unity owing to the unity of the formal object of the science.[60]

Suarez likens the unity of a science to that of a quality of the body, like health or beauty. We speak of health or beauty as though it were one quality, but in fact it is the result of the relation of many bodily qualities. The same is true of a quality of the mind such as a scientific habit. It is the product of the coordination of many simple mental qualities. Every time we learn a new demonstration or principle in a science the mind acquires a real perfection which is not simply an increase in intensity of a previous quality but a new quality of the mind. Each of these simple qualities is a "partial habit" which is integrated into the total habit of the science. Suarez does not favor the nominalist way of speaking, that there are as many sciences as there are simple habits of the mind. Even nominalists like Ockham and Gregory of Rimini, he says, agree that a science such as geometry or theology is *one* science.[61] Suarez wants to keep the usual language when speaking of the sciences, and above all to avoid extreme positions on this subject. Both the Thomists and the nominalists err in this regard: the Thomists because they fail to see that a science is comprised of many mental qualities, the nominalists because they do not realize that these qualities are so closely coordinated that they compose an essential unity. Suarez goes to great lengths to justify his assertion, against the nominalists, that a science has not simply an artificial or accidental unity but constitutes something essentially one. The partial habits that comprise a science, he contends, are linked together by an "effective subordination," because they dispose the mind to demonstrate conclusions one of which is derived from the other. The scientific habits also refer to one total object or essence, such as man, from a knowledge of which many conclusions can be drawn.[62] In the final analysis, then, it is the unity of the formal object of the science, based on the essence of things, that accounts for the unity of the science.

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When non-scholastic philosophers took up the question of the unity of a science in the seventeenth and eighteenth centuries they were continuing a discussion that already had a long history, conveniently sum-

60 Suarez, *Disputationes Metaphysicae,* 44, sect. 11 (Paris 1877) 26, pp. 697-700, n. 12-19. Suarez here presents the four opinions concerning the unity of a science and adopts the fourth or middle way. On p. 711, n. 55 he asserts that a science is a collection of many simple mental qualities. For the nature of the connection between them, see p. 713, n. 62-63.

61 *Ibid.* p. 713, n. 60.

62 *Ibid.* p. 713, n. 63. The mind, however, also has a role in the unity of a science, so that its unity is not exact or perfect but, in a way, artificial. *Ibid.* p. 715, n. 69.

marized for them in Suarez' *Disputationes Metaphysicae.* Nor were they ignorant of Suarez' work. Descartes had firsthand knowledge of it, and Leibniz boasted that he could read it as easily as most people read novels.[63] To many, the *Disputationes* were, in Schopenhauer's words, "an authentic compendium of the whole scholastic wisdom."[64]

Christian Wolff, professor of mathematics and physics at Halle and Marburg from 1706 to 1754, read Suarez with admiration and praised him as the Jesuit "who among scholastics pondered metaphysical realities with particular penetration."[65] After imbibing scholasticism at the font of Suarez, Wolff could hardly fail to describe a science as a unified whole. Indeed, in his view a science constitutes a system, comparable to an organized animal body.

While treating of natural laws in his *Philosophia Practica Universalis* Wolff says that they constitute a system, by which he means "the close union (*compactio*) by which all of them are interconnected." In general, he defines a system of doctrines as "a close union of mutually connected truths or universal propositions." This is the sense, he adds, in which he often called the first part of his *Theologia Naturalis* a system, even putting in the title of this work that it embraces a whole system, for the truths that it demonstrates about the nature of God are interconnected. In the widest possible sense a system is the close union of interconnected realities. As an example of this use of the word "system" Wolff points out that medical men speak of the nerves, arteries, and veins in the human body as a system when they describe them as diffused throughout the whole body and connected to each other so that they compose as it were one entity. Similarly, there is a system of natural laws if all the laws of nature are interconnected.[66] On this

63 *Vita Leibnitii a Seipso,* in Foucher de Careil, *Nouvelles Lettres et Opuscules Inédits de Leibniz* (Paris 1857) p. 382.

64 *Fragmente zur Geschichte der Philosophie* § 6 (Berlin 1847) 6, p. 57.

65 "Sane Franciscus Suarez e Societate Jesu, quem inter Scholasticos res metaphysicas profundius meditatum esse constat..." C. Wolff, *Philosophia Prima sive Ontologia* I, 2, 3 (Hildesheim 1962) p. 138.

66 "Per systema legum naturalium intelligo eam ipsarum compactionem, qua omnes inter se connectuntur. In genere nimirum systema doctrinarum est compactio veritatum seu propositionum universalium inter se connexarum. Immo generalissime systema appellari suevit compactio rerum inter se connexarum. Monuimus enim veritates universales, seu propositiones universales inter se connexas systema doctrinarum constituere... Et in hoc etiam sensu partem primam Theologiae naturalis in parte altera saepius diximus systema et in ipso titulo illius posuimus, quod integrum systema complectatur, quia scilicet veritates de Dei natura notae inter se connectuntur. In sensu generalissimo Medici systema nervorum, arteriarum, venarum vocant, si nervos, arterias, venas eo ordine describunt, quo per totum humanum corpus diffusi diffusaeque inter se connectuntur, ut unum quoddam quasi ens constituant nervi inter se juncti, unum ab eo diversum arteriae, et diversum ab utroque venae. Quamobrem systema legum naturalium habebis, si leges naturae omnes inter se connectantur." C. Wolff, *Philosophia Practica Universalis, Methodo Scientifica Pertractata,* II, c. 1 (Frankfurt, Leipzig, 1789) 2, pp. 65-66, n. 81.

model, too, there can be a system of doctrines, but only if the demonstrative method is used, for only then will all its propositions be mutually connected, one term being contained in the definition of another, and one proposition being the premise from which another is deduced.[67]

Wolff was not the first to use the word "body" (*corpus*) of a doctrinal system. Traditionally, the word was applied to a complete collection of writings on a subject arranged systematically. Thus the Justinian Code of law was called the *Corpus Juris*. The works of Homer were referred to as the *Corpus Homeri*. Cicero and Seneca speak of the book of an author as a *corpus*.[68] In the fourteenth century the bibliophile Richard of Bury reflects this usage when he writes of "the mighty bodies of the sciences."[69] In his *Logic*, Isaac Watts (1725) writes that "The word science is usually applied to the whole body of regular or methodical observations or propositions... concerning any subject of speculation."[70] What appears to be new in Wolff is the analogy between a system of doctrines or laws and a living human body. He sees a science as having a unity on the model of that of a living organism — an appropriate paradigm indeed for a rationalist like Wolff who attempted "to build up a philosophy in which all terms would be unequivocally defined and disposed according to an order as strict as that of mathematical demonstrations."[71]

The analogy of science to a living body was no less appealing to Kant. Wolff appeared to him as the living embodiment of metaphysics. Kant rejected that metaphysics and along with it the Wolffian notion of a scientific system; but he was too strongly influenced by Wolff to deny that science is an organic system of doctrines. As we have seen, Kant makes systematic unity the essential note of scientific knowledge. But for him a scientific system is no mere concatenation and interlinking of

67 "Systema doctrinarum condi nequit nisi methodo demonstrativa. Etenim in systemate veritates universales, quae dogmatum seu doctrinarum nomine veniunt, inter se connectuntur. Enimvero veritates inter se connectuntur, si definitum unum ingreditur definitionem alterius, et propositio una demonstrationem alterius tanquàm praemissa." *Ibid.* p. 66, n. 82.

Wolff also describes a science in the scholastic manner as a mental *habitus* of demonstrating truths: "Per scientiam hic intelligo habitum asserta demonstrandi, hoc est ex principiis certis et immotis per legitimam consequentiam inferendi." C. Wolff, *Philosophia Rationalis sive Logica,* discursus praelim. c. 2, n. 30 (Verona 1735) p. 9.

68 See references under "corpus" in A. Forcellini, *Totius Latinitatis Lexicon* (Prati 1839) I, p. 778b.

69 "Sed per plurimorum investigationes sollicitas, quasi datis symbolis singillatim, scientiarum ingentia corpora ad immensas, quas cernimus, quantitates successivis augmentationibus succreverunt." Richard of Bury, *Philobiblion* 10 (Oxford 1960) p. 108.

70 Isaac Watts, *Logic* II, 2, n. 9; cited by *The Oxford English Dictionary* (Oxford 1933) 9, p. 221.

71 E. Gilson, T. Langan, *Modern Philosophy: Descartes to Kant* (New York 1963) p. 178.

terms and propositions in the Wolffian manner. "By a system," he writes, "I understand the unity of the manifold modes of knowledge under one idea."[72] Every scientific system for Kant is regulated and constituted by an a priori idea, furnished by reason itself. Empirical knowledge by itself is not scientific unless it is regulated and systematized by a priori principles of reason.

With Kant we come full circle and return to the point where we began this inquiry into the history of the notion of the unity of a science. Standing between Kant and his predecessors is his Copernican Revolution in philosophy, which assumes that instead of our knowledge conforming to objects, objects must conform to our knowledge.[73] Thomas Aquinas lived in an age that believed that through sense experience the mind can gain an insight — however superficial and precarious — into the nature of reality and achieve truth by conforming to it. Being a realist, he was also convinced that the individuals encountered in sense experience are bearers of intelligible characters or natures which, when conceived, are the contents of our general notions. His solution to the problem of the unity of a science depends upon this metaphysical view of reality and human knowledge. For him, each of the speculative sciences has its own generic subject, or formal object, conceived through its unique mode of abstraction. Each science also has its own principles and mode of procedure, which produce in the intellect a *habitus* distinct from that of every other science.[74]

Once the nominalists eliminated intelligible natures or essences from reality a new explanation of the unity of a science had to be found. For Ockham, the object of science is no longer the real world but the propositions we form about it. Corresponding to each demonstrated proposition there is a scientific habit in the intellect. These are "partial sciences" which can be integrated into a "total science," such as physics or metaphysics, by the logical interconnection of the terms of the scientific propositions.

The mediaeval nominalists set the stage for the new notions of the unity of a science in early modern philosophy. Like them, Leibniz locates the unity of a science in the logical synthesis of the truths contained in the science. Not content with this rather loose unity, Kant bases the unity of a science on an a priori idea in the understanding. Between Aquinas and Kant, accordingly, stand the mediaeval nominalists.

72 Kant, *Critique of Pure Reason,* A 832, B 860, trans. N. K. Smith (London 1950) p. 653.

73 *Ibid.* Preface to second edition, B xvi, p. 22.

74 For St. Thomas' doctrine of the subject of science and its modes of abstraction, see *Expositio super Librum Boethii de Trinitate* Q. V-VI (Leiden 1955) pp. 161-218; trans. A. Maurer, *The Division and Methods of the Sciences* (Toronto 1968).